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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,354	03/30/2004	Noriaki Fukiage	071469-0308969 (FKL-020)	4104

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EXAMINER	
LAFOND, RONALD D	

ART UNIT	PAPER NUMBER
1709	

MAIL DATE	DELIVERY MODE
06/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/812,354	FUKIAGE, NORIAKI	
	Examiner	Art Unit	
	Ronald D. Lafond	1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) *29-34* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/30/2004, 06/17/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 29 – 34 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 06/02/2007.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 11, 13, and 16 – 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsukune, et al (European Patent Application 0 387 656 A1, hereafter Tsukune).

4. Regarding Claims 1, 11, 13, and 16, Tsukune teaches a method for operating a plasma enhanced chemical vapor deposition (PECVD) system, comprising: a) performing a chamber seasoning process, wherein the chamber seasoning process comprises a chamber cleaning process and a chamber pre-coating process, wherein the chamber cleaning process uses NF_3 (see Column 3, lines 6 – 10) and wherein the chamber pre-coating process uses SiH_4 and N_2 (see Column 3, lines 11 – 18); b) positioning a substrate on a substrate holder in the processing chamber (see Column 3, lines 19 – 22); and c) depositing a film on the substrate, wherein a processing gas comprising a precursor is provided to the processing chamber during the deposition process (see Column 3, lines 22 – 28). While Tsukune does not explicitly teach removing the substrate from the processing chamber, it is an inherent feature of coating processes that the article being coated is removed from the system after the processing is complete – the article being coated is not intended to be left in or used only in the reactor system.

5. Regarding Claim 17, Tsukune teaches the method as claimed in claim 1, wherein the PECVD system comprises an RF source and the chamber seasoning process includes the chamber cleaning process which further comprises: operating the RF source at a frequency of 13.56 MHz; and operating the RF source at a power of 300 W (see Column 3, lines 6 – 10).

6. Regarding Claim 18, Tsukune teaches the method as claimed in claim 1, wherein the PECVD system comprises an RF source and the chamber seasoning process includes the chamber pre-coating process which further comprises: operating the RF source at a frequency of 13.56 MHz; and operating the RF source at a power of 300 W (see Column 3, lines 11 – 18).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2 – 4, 14, 24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Ravi (United States Patent 5,952,060).

9. Regarding Claim 2, Tsukune does not teach the method further comprising: positioning a new substrate on the substrate holder in the processing chamber; depositing a film on the new substrate, wherein a processing gas comprising a precursor is provided to the processing chamber during the deposition process; and removing the new substrate from the processing chamber. However, Ravi teaches just such a method, wherein multiple substrates are processed within the chamber (see Claim 13 and Column 1, lines 24 – 35). It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by processing multiple substrates as taught by Ravi in order to have gained the advantage of processing multiple substrates in a deposition process and because Ravi teaches that processing multiple substrates is known in the art.

10. Regarding Claims 3 and 4, Tsukune does not teach the method further comprising performing a post-process chamber cleaning process, wherein the post-process chamber cleaning process uses NF_3. However, Ravi again teaches just such a limitation (see Claim 15 and Column 1, lines 35 – 52). Ravi further teaches, at Column 1, lines 35 – 52, that "some of the gases used during substrate processing are especially corrosive, and tend to etch material form the processing chamber's interior surfaces. Thus, one of the difficulties confronting users of substrate processing systems is the etching experienced by components exposed to reactants. For example, as a film is deposited on a substrate, some of the material being deposited also accumulates on the processing chamber's walls and must be removed periodically. This removal is done during cleaning operations in which process gases are evacuated form the processing chamber and an etchant gas such as NF_3 is introduced." It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by performing a post-process chamber cleaning process as taught by Ravi to have gained the advantage of preventing corrosion of interior reactor surfaces with a reasonable expectation of success, because Ravi teaches that is known in the art to do so.

11. Regarding Claim 14, Tsukune does not teach the method wherein the chamber pre-coating process employs CH_4 (methane). However, Ravi teaches just such a limitation (see Column 8, lines 51 – 67), in which methane is used as a precursor for the formation of diamond-like coatings in a pre-coating process. It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by using methane as the precursor in a chamber pre-coating process as taught by Ravi with a reasonable expectation of success, because Ravi teaches that methane can successfully be used for the deposition of diamond-like coatings in plasma deposition chambers (see Column 8, lines 11 – 67).

12. Regarding Claims 24 and 25, Tsukune teaches the method wherein the chamber cleaning process comprises controlling the chamber pressure to 0.5 Torr (see Column 3, lines 6 – 10) and the chamber pre-coating process comprises controlling the chamber pressure to 1 Torr (see Column 3, lines 11 – 18). Tsukune does not explicitly teach that the PECVD system comprises a pressure control system coupled to the chamber to achieve these pressures. However, Ravi teaches just such a limitation (see

Column 4, lines 1 – 21 and 66 – 67, and Column 5, lines 1 – 8). It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the system of Tsukune by including a pressure control system as taught by Ravi to have controlled the pressure to the levels taught by Tsukune with a reasonable expectation of success, because Ravi teaches that such a system is known in the art.

13. Claims 9 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Mahorowala, et al (Mahorowala, A.P., Babich, K., Petrillo, K., Simons, J., Angelopoulos, M., Patel, V., and Grill, A. "Tunable Anti-Reflective Coatings with Built-in Hard Mask Properties Facilitating Thin Resist Processing," Proceedings of SPIE (4343) : 306 – 316, 2001).

14. Regarding these Claims, Tsukune does not teach the method wherein the film on the substrate comprises a Tunable Etch Resistant ARC (TERA) material, and wherein the film comprises a material having a refractive index (n) ranging from approximately 1.5 to approximately 2.5 when measured at a wavelength of at least one of: 248 nm, 193, nm, and 157 nm, and an extinction coefficient (k) ranging from approximately 0.1 to approximately 0.9 when measured at a wavelength of at least one of: 248 nm, 193, nm, and 157 nm. However, Mahorowala teaches just such limitations, wherein PE-CVD is used to deposit TERA films with these properties (see pp. 308 – 311). It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by depositing a TERA film as taught by Mahorowala with a reasonable expectation of success, because Mahorowala teaches that PECVD is a suitable method for deposition of TERA films.

15. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Ravi, and further in view of Mahorowala. Tsukune in view of Ravi does not teach the method wherein the film on the substrate comprises a TERA material, and the film on the new substrate comprises substantially the same TERA material. However, as discussed, Mahorowala teaches the deposition of TERA films from TERA materials via PE-CVD. It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune in view of Ravi by depositing a TERA film as taught by Mahorowala on multiple substrates, because Mahorowala teaches that PECVD is

a suitable method for deposition of TERA films and because Ravi teaches that it is well-known in the art to process multiple substrates in a deposition chamber.

16. Claims 10, 12, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Hashizume, et al (United States Patent 6,410,102, hereafter Hashizume).

17. Regarding Claim 10, Tsukune does not teach the method comprising positioning a dummy substrate on the substrate holder before performing the chamber seasoning process, and removing the dummy substrate after performing the chamber seasoning process. However, Hashizume teaches just such a limitation, wherein a dry etch cleaning process is performed with a dummy substrate (see Column 10, lines 27 – 40, "In order to prevent damage on the ... heaters, dummy cylindrical substrates ... are set ... in the deposition chamber and the inside of the chamber is vacuumized ..."). Applicant specifies, in Claim 1, that a "chamber seasoning process comprises a chamber cleaning process." While Hashizume does not explicitly teach removing the dummy substrate before a substrate processing step is performed, it is an inherent feature of a dummy substrate employed in a chamber pre-cleaning process before a substrate processing step that the dummy substrate must be removed before the regular substrate processing begins. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by using a dummy substrate during the cleaning process as taught by Hashizume with a reasonable expectation of success, because Hashizume teaches that the use of a dummy substrate during dry cleaning processes is well-known in the art, and to have gained the advantages taught by Hashizume, i.e. to prevent damage to the substrate heater during dry etch cleaning.

18. Regarding Claims 12 and 15, Tsukune does not teach the method wherein the chamber cleaning process employs O_2 and wherein the chamber cleaning process employs Ar. However, Hashizume teaches just such limitations, wherein oxygen and argon are used in addition to a fluorine-containing gas in a chamber cleaning process (see Column 10, lines 27 – 40). It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by employing O_2 and Ar as components in a chamber cleaning process as taught by Hashizume with a reasonable expectation of success, because Hashizume teaches that it is known in the art to do so.

19. Claims 5 – 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Ravi, and further in view of Hashizume.

20. Regarding these Claims, Tsukune in view of Ravi does not teach the method wherein the post-process chamber cleaning process uses O_2 and Ar, and wherein the method further comprises positioning a dummy substrate on the substrate holder before performing the post-process chamber cleaning process and removing the dummy substrate after performing the post-process chamber cleaning process. However, as discussed, Hashizume teaches all of these limitations for a cleaning process. It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune in view of Ravi by using O_2 and Ar in a chamber post-cleaning process that employs a dummy substrate as taught by Hashizume with a reasonable expectation of success, because Hashizume teaches that such a method is well-known in the art.

21. Claims 19 – 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Law, et al (United States Patent 4,960,488, hereafter Law).

22. Regarding these Claims, Tsukune does not teach the method wherein the PECVD system comprises an upper electrode and a translatable substrate holder and the chamber seasoning process includes the chamber cleaning process which further comprises: establishing a first gap between the upper electrode and the translatable substrate holder during a first time; and establishing a second gap between the upper electrode and the translatable substrate holder during a second time, and wherein the first gap is less than or equal to the second gap or wherein the second gap is less than or equal to the first gap. However, Law teaches just such limitations, wherein a multiple dry etch process is used to clean *in situ* a PECVD chamber (see Column 11, Lines 61 – 68, and Column 12, lines 1 – 2) and wherein the first gap is less than the second gap (see Column 12, lines 20 –38). Moreover, Claim 19 as written does not specify that the second gap established during a second time necessarily occurs *after* the first gap established during the first time – thus, the method taught by Law reads on both Claims 20 and 21. Furthermore, Law states the advantages of using this process, in Column 12, lines 12 – 19, as "thus, while the operation of the present reactor is cleaner than conventional reactors and while cleaning can be done less frequently, the ability to clean both the vacuum system and the reactor chamber rapidly and

frequently, if necessary, is very desirable in preventing particulate contamination and in ensuring long-term proper operation of components such as the throttle valve." Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by using the dual-step chamber cleaning process taught by Law to have obtained the advantages taught by Law with a reasonable expectation of success, as Law teaches that such a process is known in the art.

23. Claims 22, 23, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Kuwada, et al (United States Patent Application Publication US 2002/0029748 A1, hereafter Kuwada).

24. Regarding Claim 22, Tsukune does not teach the method wherein the PECVD comprises a temperature control system coupled to a substrate holder and the chamber cleaning process comprises controlling the substrate holder temperature between approximately 0 C and 500 C. However, Kuwada teaches just such limitations, wherein a heat lamp or a resistance heater is used to heat the substrate holder (see paragraph [0046]) and wherein the temperature of the substrate holder is held to about 250 C during chamber cleaning (see paragraphs [0080] and [0081]). Moreover, Kuwada teaches, in paragraph [0065], that "after the emitted heat ... is transmitted through the transmission window, a back surface of the susceptor is irradiated, and the wafer is heated from the back surface thereof. Since the susceptor ... is very thin ..., the susceptor is quickly heated, and the wafer load on the susceptor can also quickly be heated to a predetermined temperature." Therefore, Kuwada is implicitly teaching that it is advantageous to have temperature controlled substrate holders in order to precisely control the temperature of the substrate during deposition or processing. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by using a temperature control system coupled to a substrate holder and by performing a cleaning process which comprises controlling the substrate holder temperature to 250 C as taught by Kuwada with a reasonable expectation of success, because Kuwada teaches that is known in the art to do so.

25. Regarding Claim 23, Tsukune in view of Kuwada teaches the method wherein a PECVD system comprises a temperature control system coupled to a substrate holder, but does not explicitly teach the

method wherein the substrate holder temperature is controlled between about 0 and about 500 C during a pre-coating process. However, Tsukune does teach, in Column 3, lines 50 – 58, that "the temperature within the chamber [during pre-coating] is set to 350 C." It would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune in view of Kuwada by using the temperature control system of the substrate heater as taught by Kuwada to control the temperature during the pre-coating process to about 350 C as taught by Tsukune with a reasonable expectation of success, because a substrate heater element is inherently capable of heating a chamber.

26. Regarding Claim 27, Tsukune does not teach the method wherein the PECVD system comprises a temperature control system coupled to a shower plate assembly and the chamber cleaning process further comprises controlling the shower plate assembly temperature between approximately 0 and 500 C. However, Kuwada teaches just such limitations, wherein a shower plate assembly is heated by various elements during a cleaning process (see paragraphs [0049], [0051], [0054], [0055], and especially [0078]). Moreover, Kuwada teaches, in paragraph [0096], that "the head heating/cooling portion cools the head main body during the film forming process to further enhance reproducibility of the film thickness, and heats the main body during the cleaning process in order to further efficiently remove the reactive byproduct." Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by including a temperature-controlled showerhead assembly as taught by Kuwada and by controlling the temperature of the showerhead during cleaning to approximately 150 C as taught by Kuwada to have achieved the advantages taught by Kuwada (i.e., complete cleaning of the showerhead apparatus during the system etch with fluorinated-gas) with a reasonable expectation of success, because Kuwada teaches that such a method of showerhead cleaning is known in the art.

27. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukune in view of Steger, et al (United States Patent 5,788,799, hereafter Steger).

28. Tsukune does not teach the method wherein the PECVD system comprises a temperature control system coupled to a chamber wall and the chamber cleaning process comprises controlling the chamber

wall temperature between approximately 0 C and 500 C. However, Steger teaches just such limitations, wherein a chamber wall surface is temperature controlled to ensure fast and efficient cleaning (see Column 4, lines 11 – 33, and Column 5, lines 11 – 32). Steger teaches, in Column 5, lines 23 – 32, that "when the ceramic liner assists in the cleaning of a reactor chamber after the semiconductor substrate has been removed, since the clean rate is typically exponential with temperature, the ceramic liner temperature setting will be as high as is practical, depending on the equipment involved." Steger further teaches, in Column 9, lines 53 – 55, a number of potential cleaning wall temperatures ranging from 65 C to 250 C utilizing NF_3. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the present invention to have modified the method taught by Tsukune by including a temperature-controlled chamber wall as taught by Steger and by controlling the temperature of the chamber wall during cleaning to 65 to 250 C with a reasonable expectation of success, because Steger teaches that such a method of chamber wall cleaning is known in the art.

Conclusion

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald D. Lafond whose telephone number is (571) 270-1878. The examiner can normally be reached on M-F 7:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RDL

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SUPERVISORY PATENT EXAMINER